REMARKS

Summary

This Amendment is responsive to the Office Action mailed on March 31, 2004. Claims 14 and 40 are amended herein. Claims 1 and 3-41 are pending.

The Examiner has objected to the Information Disclosure Statement (IDS) filed on March 4, 2004, which was a re-submission of the IDS filed on January 8, 2001 IDS. The Examiner again indicates that EP 0 851 656 referenced on the IDS was not included with the IDS. Applicants respectfully submit that all copies of the references were submitted with both the January 8, 2001 IDS and the March 4, 2004 IDS. Attached is a copy of EP 0 851 656 submitted with Applicants' IDS forms, together with a copy of a PTO-1449 form listing the reference. Applicants respectfully request that the Examiner consider the attached EPO reference and initial and return the attached PTO-1449 form with the next official communication.

Claims 1-3, 9-12, 16-18, and 26 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Huang (US 6,570,888).

Claims 4-8, 13-15, 19-25, 40, and 41 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang in view of Zhang (US 6,483,543).

Claims 27-34 and 37-39 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Zhang in view of Balakrishnan (US 5,566,208).

Claims 35 and 36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Zhang in view of Balakrishnan and Huang.

Applicants respectfully traverse these rejections in view of the amended claims and the following comments.

Discussion of Amended Claims

Claim 14 is amended back into its original dependent form. Claim 40, which is an apparatus claim corresponding to method claim 14, is amended into dependent form and depends on claim 26.

Discussion of Cited References

The Examiner has rejected claims 1-3, 9-12, 16-18, and 26 as being anticipated by Huang. This rejection is respectfully traversed. An anticipation rejection requires that each and every element of the claimed invention as set forth in the claim be provided in the cited reference. See *Akamai Technologies Inc. v. Cable & Wireless Internet Services Inc.*, 68 USPQ2d 1186 (CA FC 2003), and cases cited therein. As discussed in detail below, Huang does not meet the requirements for an anticipation rejection.

Huang discloses techniques for determining an output rate for a bit stream by applying information read from the bitstream to a model of a receiver for the bitstream. These techniques are used to construct a statistical multiplexer (Abstract).

Applicants' claimed invention relates to statistical remultiplexing in a transcoder which receives a plurality of encoded video streams, each of which is at respective first bit rates, and re-encodes the video streams at respective second bit rates, as necessary for statistical remultiplexing.

Huang does not disclose or remotely suggest statistical remultiplexing of encoded video streams, as set forth in Applicants' claims.

Claims 1 and 9

As indicated by the Examiner, Huang discloses storing the video frame in a statistical multiplex buffer (SMB 507) to achieve a delay (Col. 9, lines 18-26; Figure 5). However, the arrangement and function of the SMB 507 of Huang is not equivalent to Applicants' claimed lookahead buffer, which stores the video frames in order to delay transcoding of the video frames while statistical information for use in the transcoding process is obtained from the future video frames.

Huang explicitly states that the encoder 107 has no knowledge of the process that takes place at the statistical multiplexer. Further, Huang explicitly states that all the information required for allocating the bandwidth using the technique disclosed in Huang need only be exchanged between the bandwidth allocator 813 and the transmission controller 807 (see, e.g., Col. 7, lines 35-44). The SMB buffer 507 of Huang is part of the statistical multiplexer 401, and therefore information obtained at the SMB 507 is not exchanged with the encoder 107 as is apparently assumed by the Examiner.

The process disclosed in Huang is related to a rate control process which occurs after encoding is completed. In Huang, the SMB 507 is used to buffer the encoded bursty data before it is delivered to packet delivery controller 419. A meter 505 monitors the fullness of SMB 507 and provides information concerning the degree of fullness to

TRC 413, which uses this information to vary the range of bit rates it provides to packet delivery controller 419 as required to keep SMB 507 from overflowing or underflowing (Col. 9, lines 34-47). The degree of buffer fullness may be fed back from meter 505 to the encoder 107, and used there to increase or decrease the encoding rate of the remainder of the bit stream (Col. 9, lines 47-49).

The Examiner has apparently equated the TRC 413 of Huang with Applicants' transcoder. TRC 413 of Huang is not equivalent to Applicants' claimed transcoder. TRC 413 of Huang TRC 413 does not decompress and then recompress the encoded data, it merely controls buffer output from buffer 507 (Col. 9, lines 44-47). Further, analyzer 409 does not obtain info from the buffer 507 of Huang as indicated by the Examiner (Office Action, page 21), as there is no feed line from the buffer 507 to the analyzer shown in Figure 4. Rather, analyzer 409 obtains info directly from the encoded bitstream as it enters the controller 407 (Col. 8, lines 27-51). Further, the meter 505 only reports on the fullness of the buffer 507 to the TRC 413. This is not statistical information obtained from the video frames stored in the buffer which is used to determine bit rate need parameters for transcoding the data.

Further, the bit rate need parameter set forth in Applicants' claims 1 and 9 determines the amount of data (i.e., number of bits) allocated for transcoding of each video frame (see, e.g., Applicants' specification, page 2, lines 4-9). TRC 413 is not concerned with a bit rate need parameter for encoding or transcoding the frames of video data, but only the bit rate at which the already encoded data is ultimately transmitted.

In contrast to Huang, as the delay provided by Applicants' lookahead buffer is achieved before transcoding, *a priori* statistical information regarding the encoded input video streams may be used to optimize the transcoding. In contrast, since the SMB 507 of Huang is arranged after the encoder 107 and is not in communication with the encoder 107, statistical information obtained during the delay provided by SMB 507 of Huang cannot be used during the encoding of the raw video data stored in the buffer 507, since that data is already encoded.

An important difference between the present invention and that of Huang is that the Applicants' claimed transcoder actually reduces the amount of information (e.g., by requantization) in the bit stream so that the bit stream requires a lower bit rate when transmitted. In contrast, the transmission rate controller TRC 413 of Huang merely regulates the transmission bit rate of a given encoded data stream.

In summary, Huang does not disclose or remotely suggest storing the video frames in a lookahead buffer in order to delay transcoding of the video frames while obtaining statistical information therefrom for use in transcoding, as claimed by Applicants in claims 1 and 9. In particular, Huang does not discuss transcoding. Further, the delay in Huang occurs after the bit stream is encoded, so that there is no delay of encoding or transcoding of the video frames while the statistical information is obtained.

Therefore, Huang does not disclose or remotely suggest determining respective bit rate need parameters for the video frames according to the statistical information obtained during the delay and transcoding the respective

video frames in accordance with the respective bit rate need parameters following the delaying thereof, as claimed by Applicants.

Claims 10 and 26

Claims 10 and 26 specify computing a target frame size for the particular video frame that indicates an amount of data that is expected to result from transcoding the particular video frame, wherein the target frame size is bounded by at least one of minimum and maximum predicted values that are updated in the successive intervals and the transcoding bit rate for the particular video frame in the successive intervals is determined in accordance with the target frame size.

The Examiner argues that VBV 415 estimates the characteristics of bit streams that will be output and received after being coded and transmitted from switch 511 at decoders 119, thereby providing expected results before transmission to aid in configuring the coded transmission (Office Action, page 21). In Huang, VBV 415 is used to prevent overflow or underflow of the decoder bit buffer 119 (Col. 8, lines 15-19). Timing and picture size information from the VBV 415 is used by TRC 413 in making its rate determination (Col. 8, lines 8-14). However, this rate determination is made after the data is already encoded. This rate determination is not connected with the encoding process of Huang, which is completely separate and not dependent on the rate control process as discussed above in connection with claims 1 and 9.

In contrast, with Applicants' claimed invention as set forth in claims 10 and 26, the target frame size is the

amount of data expected to result from transcoding of the data. Accordingly, the minimum and maximum values which bound the target frame size are predicted values which are determined before transcoding of the video frames. With Applicants' claimed invention, the target frame size and the minimum and maximum predicted values which bound the target frame size are parameters used to guide the transcoding process. Bit allocation and picture quality are optimized when the application of minimum/maximum bit rate constraints is minimized. In contrast, the rate control process of Huang is performed on already encoded data where the frame size has already been determined.

As discussed above, TRC 413 of Huang is not equivalent to Applicants' claimed transcoder. TRC 413 of Huang merely controls the range of bits provided to packet delivery controller 419 as required to keep buffer SMB 507 from overflowing or underflowing (Col. 9, lines 44-47). Applicants' claimed transcoder actually changes (i.e., reduces) the amount of data in the bitstream so that the bitstream can be transmitted at a lower bit rate. The TRC 413 of Huang has nothing to do with setting a target frame size for a video frame that indicates an amount of data expected from transcoding, as claimed by Applicants. In contrast, Huang discloses only that, given the minimum buffer size, the timing information for the pictures, and the sizes of the individual pictures, the VBV model 415 can determine the rate of output for the bitstream (Col. 8, line 67 through Col. 9, line 5).

Huang does not disclose or remotely suggest computing a target frame size for the particular video frame that indicates the amount of data that is expected to result

from transcoding of the particular video frame, which target frame size is bounded by minimum and maximum predicted values that are updated at successive intervals.

Claims 14 and 40

Claims 14 and 40 are amended into dependent form, and now depend on claims 10 and 26 respectively. Therefore, the arguments set forth above with respect to claims 10 and 26 apply equally to claims 14 and 40.

As Huang does not disclose each and every element of the invention as claimed in claims 1-3, 9-12, 16-18, and 26 the rejections under 35 U.S.C. § 102(e) are believed to be improper, and withdrawal of the rejections is respectfully requested. See, *Akamai Technologies Inc., supra*.

Claims 24 and 41

Claims 24 and 41 specify estimating a time for inserting clock reference data into at least one packet comprising transcoded data of the particular video frame according to the target frame size. The Examiner has rejected claims 24 and 41 as being unpatentable over Huang in view of Zhang.

As discussed above in connection with claims 10 and 26, the Examiner's rejections, based primarily on the assumption that the TRC 413 of Huang is equivalent to Applicants' transcoder, are misplaced. Further, Huang does not transcode encoded video frames. Huang is concerned with encoding raw video data. Therefore, the locations of the program clock references (PCRs) of Huang can be easily preserved during the encoding process. However, when a

bitstream is transcoded, the number of output packets is different from the number of input packets. Therefore, it would not have been obvious in view of Huang to estimate the time for inserting the clock reference data (PCR packets) into the output transcoded data, as claimed by Applicants in claims 24 and 41.

Therefore, the combination of Huang and Zhang does not disclose or remotely suggest estimating a time for inserting clock reference data into at least one packet comprising transcoded data of the particular video frame according to the target frame size, as set forth in Applicants' claims 24 and 41.

Claims 27 and 39

Claims 27 and 39 are rejected as being unpatentable over Zhang in view of Balakrishnan. In particular, the Examiner indicates that Balakrishnan discloses using a compression ratio of input bits to output bits that varies with the content of the digital information (Office Action, page 13).

However, Balakrishnan does not disclose how to use the "compression ratio" to control the quantizer scale, as set forth in Applicants' claims 27 and 39. The compression ratio is derived from the ratio of the input bit rate versus the output bit rate. However, the compression ratio does not automatically imply the ratio of the quantizer scales, as suggested by the Examiner. For example, on an encoder (such as disclosed in Huang) one can set the compression ratio by merely setting the output bit rate of the encoder (i.e., via TRC 413 of Huang). However, it is a much more complicated matter to determine how to quantize

the signal (i.e., at the encoder 107 of Huang) just from the knowledge of what the desired bit rate should be.

With Applicants' invention, the compression ratio is used to relate the input (old) quantizer scale to the output quantizer scale. This algorithm ensures that the output quantization scale is higher than the input quantization scale. Applicants' respectfully submit that such a result would not have been obvious to one skilled in the art without the use of prior art clipping and/or clamping techniques.

The combination of Zhang and Balakrishnan does not disclose or remotely suggest determining new quantization scales for use in transcoding corresponding macroblocks in a first portion of the particular video frame in accordance with (a) the corresponding old quantization scales, and a ratio of (b) a pre-transcoding amount of data in the particular video frame to (c) the target amount of data, as set forth in Applicants' claims 27 and 39.

Applicants respectfully submit that the present invention is not anticipated by and would not have been obvious in view of Huang or Zhang, taken alone or in combination with any of the other prior art of record.

Further remarks regarding the asserted relationship between Applicants' claims and the prior art are not deemed necessary, in view of the foregoing discussion. Applicants' silence as to any of the Examiner's comments is not indicative of an acquiescence to the stated grounds of rejection.

Withdrawal of the rejections under 35 U.S.C. § 102(e) and 35 U.S.C. § 103(a) is therefore respectfully requested.

Conclusion

The Examiner is respectfully requested to reconsider this application, allow each of the pending claims and to pass this application on to an early issue. If there are any remaining issues that need to be addressed in order to place this application into condition for allowance, the Examiner is requested to telephone Applicants' undersigned attorney.

Respectfully submitted,

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ATTORNEY DOCKET NO.: GIC-614
Date: June 29, 2004